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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/813,784	03/30/2004	Chien-Chao Huang	67,200-1289	5209

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TUNG & ASSOCIATES  
838 W. Long Lake Road, Suite 120  
Bloomfield Hills, MI 48302

EXAMINER

LEE, HSIEN MING

ART UNIT PAPER NUMBER

2823

DATE MAILED: 01/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/813,784

Applicant(s)

HUANG, CHIEN-CHAO

Examiner

Hsien-ming Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-18, 20-25, 27-35, 37-41 and 43-48 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 24, 25, 27-35, 37-41, 43, 44, 47 and 48 is/are allowed.
- 6) ☒ Claim(s) 1-7, 11 and 12 is/are rejected.
- 7) ☒ Claim(s) 8-10, 13-18, 20-23, 45 and 46 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

HSIEN-MING LEE  
PRIMARY EXAMINER

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Remarks*

1. The objection to claims 1, 13, 24 and 25; 112-second-paragraph rejection to claim 24 and 102(b) rejections have been withdrawn.

### *Claim Objections*

2. Claims 1, 13, 15 and 22 are objected to because of the following informalities:  
  
In claim 1, in step e), the term "ALCU portion" should have been as -- AlCu portion --.  
  
In claim 13, at the very last line, "AlCu interconnect line;" should have been as – AlCu interconnect line . --.  
  
In claim 15, at line 3, "pressures" should have been as -- pressure --.  
  
In claim 22, at line 2, "are repeated are repeated " should have been as – are repeated --.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:  
  
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
4. Claims 1-4, 7, 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dixit et al (US 6,355,558) in view of Zhou (US 6,376,353).  
  
In re claims 1 and 7, Dixit et al., in Figs. 1-4D and related text, teach a method of forming a multi-level semiconductor device wiring interconnect structure comprising the steps of:  
  
a) forming a dielectric insulating layer 26 over a conductive portion 24 (Fig.1);

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b) forming a via opening 34 in closed communication with the conductive portion 24 (Fig. 1);

c) forming a first barrier layer 44 comprising TiN to line the via opening 34 (Fig.2B);

d) then forming a layer of AlCu 50 to fill the via opening 34 to form an AlCu via 50 including a portion of the AlCu layer 50 overlying the dielectric insulating layer 26 (Fig.2E); and

e) forming an AlCu interconnect line (i.e. the patterned portion of AlCu 50) (from Fig.2F to Fig.3) from the AlCu portion 50 over the AlCu via, wherein a second barrier layer 52 (i.e. Ti/TiN) is formed on the AlCu interconnect line.

Dixit et al. do not teach that process steps c) and d) are carried out at a temperature of less than about 400 degrees Centigrade.

Zhou et al. teach using the magnetron sputtering for depositing Al-Cu layer for obtaining a good adhesion property (col. 11, lines 32-34 and col. 12, lines 7-8), wherein the temperature is about 25 to 500°C (col. 11, lines 36-37), which covers the claimed range of less than about 400 °C.

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to use the magnetron sputtering technique, as taught by Zhou et al., for depositing the Al-Cu layer of Dixit et al., since by doing so it would form an Al-Cu layer having a good adhesion property.(col. 12, lines 7-8, Zhou et al.)

In re claim 2, Dixit et al. teach that steps a) through e) are repeated to sequentially form an overlying AlCu via contiguous with an overlying AlCu interconnect line as shown in Fig. 4D.

In re claim 3, Zhou et al remedy the deficiency in Dixit et al. because Zhou et al. teach using the magnetron sputtering for depositing Al-Cu layer at a temperature is about 25 to 500°C (col. 11, lines 36-37)

In re claim 4, Zhou et al. also remedy the deficiency in Dixit et al. because Zhou et al. teach that the pressure in the magnetron sputtering is about 0.1 to 10,000 mTorr (col. 11, line 35), which covers the claimed range of less than about 5 mTorr.

In re claim 11, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to repeat the processing steps in order to form multi-level metallization layers as many as three or more as desired.

In re claim 12, it would have been obvious to one of the ordinary skill in the art, at the time of the invention was made, to comprehend that the multi-level semiconductor device consisting essentially of AlCu wiring because each level metallization consisting essentially of AlCu (i.e. layer 50 in Dixit). By repeating layer 50 (i.e. AlCu), it would form multi-layers semiconductor device consisting essentially of AlCu.

5. Claims 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dixit et al. in view of Zhou et al., as applied in claim 1 above, further in view of Chang et al. (US 6,159,842).

In re claims 5 and 6, Dixit et al. in view of Zhou et al. do not teach using a FSG for the dielectric insulating layer.

Chang et al. teach using a FSG for dielectric insulating layer 16 in adjacent to a AlCu layer 14.

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to use the dielectric insulating consisting essentially of FSG, as taught

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by Chang et al., as the dielectric insulating layer of Dixit et al., since by this manner it would provide a good protection for the AlCu layer (col. 23, lines 48-50, Chang et al.).

***Allowable Subject Matter***

6. Claims 24, 25, 27-35, 37-41, 43, 44, 47 and 48 are allowed.
7. Claim 13 would be allowable if amended to overcome the objection, as set forth in this Office action.
8. Claims 8-10 and 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
9. Claims 14-18, 20-23 and 46 are objected to as being dependent upon an objected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
10. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record neither teaches nor suggests that the conductive portion comprises silicide electrical contact areas comprising a CMOS transistor portion (claims 8 and 13); the second barrier layer encapsulates the AlCu interconnect line on three sides (claim 24).

***Conclusion***

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO**

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MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-ming Lee whose telephone number is 571-272-1863. The examiner can normally be reached on Tuesday-Thursday (7:30 ~ 6:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hsien-ming Lee  
Primary Examiner  
Art Unit 2823

Jan 20, 2006

**HSIEN-MING LEE**  
**PRIMARY EXAMINER**

*1/20/06*